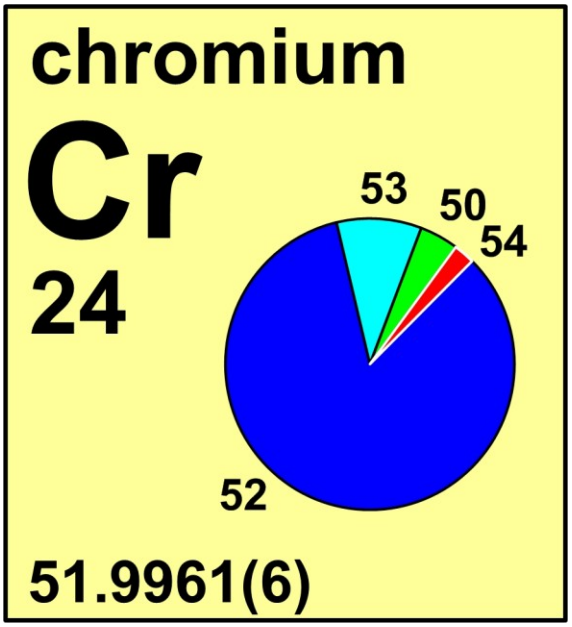
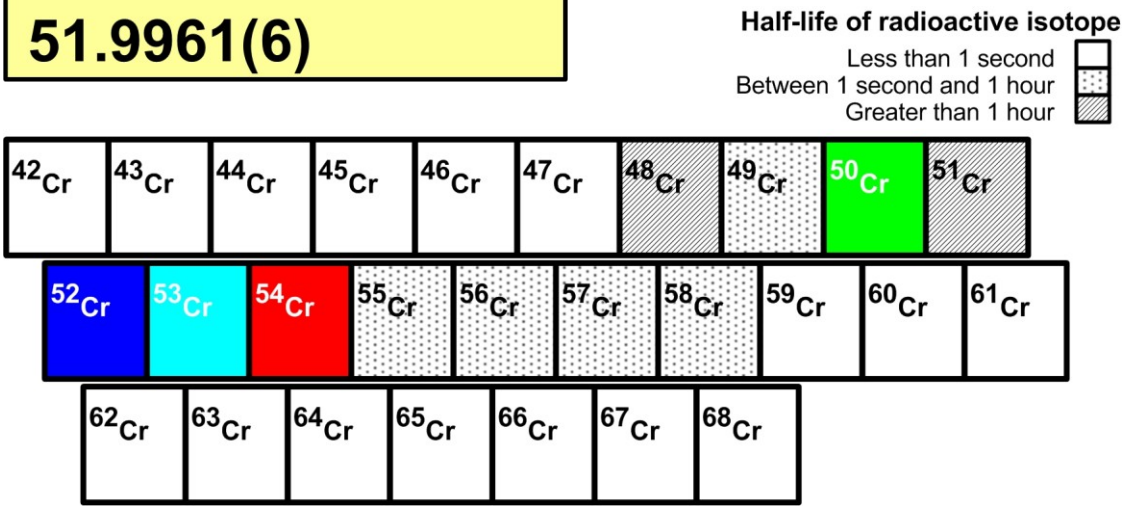
chromium



Stable isotope	Atomic mass*	Mole fraction
^{50}Cr	49.946 0442	0.043 45
^{52}Cr	51.940 5075	0.837 89
^{53}Cr	52.940 6494	0.095 01
^{54}Cr	53.938 8804	0.023 65

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

1) Stable isotopes of chromium are used to investigate the metabolism of this element by the body.
2) Enriched amounts of ^{53}Cr and ^{54}Cr are administered to a patient and the relative metabolic activity of each isotope is measured to study insulin function in patients suffering from diabetes.
3) ^{51}Cr and ^{53}Cr can be used to study red blood cell volume and survival.

Isotopes in planetary science

1) SiC grains are formed in very high temperature events that occurred before the formation of the solar system and provide insight into the origins of the universe. The ^{54}Cr nucleus

is only produced by supernovae and excess amounts of this isotope in the SiC grains (relative to terrestrial isotopic composition) found in primitive meteorites suggest a heterogeneous distribution of ^{54}Cr in the early solar system and thus different sources of material to our solar system.

2) The early solar nebula was divided into two components, where one contained light chromium isotopes and the other contained heavy chromium isotopes. These components formed a homogeneous mixture in the early Earth but separated during core partitioning.

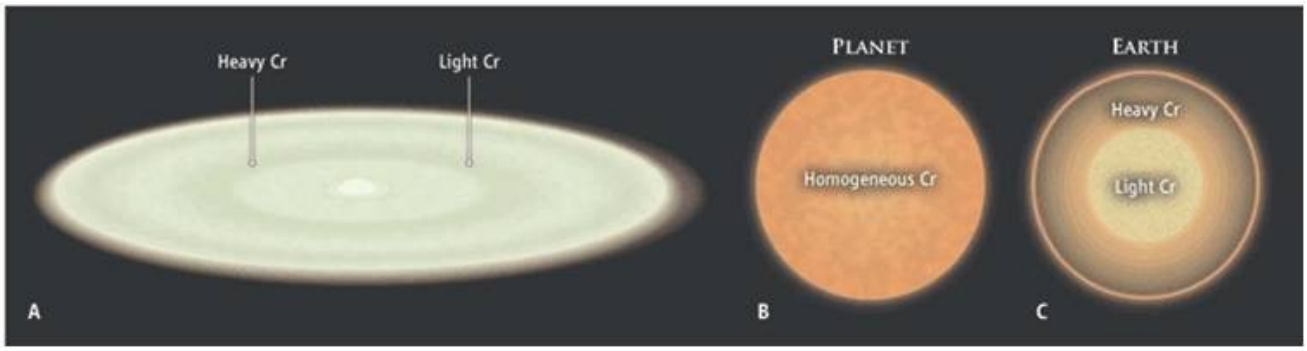


Figure 1: (A) Chromium isotopes were divided into two components in the early solar nebula. (B) The early Earth was a homogeneous mixture of chromium isotopes. (C) During the core partitioning of the Earth, the core became enriched with lighter chromium isotopes and the mantle became enriched with heavier chromium isotopes. (Image Source: P. HUEY, SCIENCE).

Isotopes in environmental studies

1) The mobility and toxicity of chromium metal depends largely on the oxidation state of the element. Isotopes of chromium are fractionated by reduction-oxidation (redox) chemical reactions and isotope composition can be used to trace the origin of the element in the environment and indicators of redox processes.